a cubic function with a single root having minimal deviation from zero near the root so that longitudinal mode hopping will not occur during tuning. See Col. 3, lines 57-62.

Akimoto et al. disclose a tunable laser diode (LD) with a Si micromirror in FIG. 5. The side walls of cantilever beam and each stator form capacitors for electrostatic actuation. When a driving voltage is applied between the cantilever beam and one of the stators, the beam is bent and attracted to that stator. Stator electrodes are located on both sides of the cantilever beams, so it can be moved in either direction. The amount of cantilever beam deflection is much smaller than its length, so the sidewall mirror remains almost parallel to the LD facet. The LD is bonded close to the cantilever beam because of its lens-less short-external-cavity configuration. Page 375. A short-external-cavity tunable LD having a Ni micromirror and a conventional LD chip is shown in FIG. 14. The LD is bonded about two microns from the mirror. The LD facet facing the mirror is anti-reflection coated. Page 380.

Claim 1, as amended, is patentable by calling for a single mode laser microassembly of the type set forth therein having, among other things, an electromechanical micro-actuator coupled to one of the diffractive element and the reflective element for selecting a single wavelength from the range of wavelengths by altering the optical path of the light.

In rejecting Claim 1 over Lang et al., the Examiner acknowledges that Lang et al. do not disclose a micro-actuator for tuning the laser system to obtain different wavelengths. The Examiner further states that Akimoto et al. disclose the use of micro-electro mechanical systems technologies in tunable laser diodes and, therefore, it would have been an obvious to a person having ordinary skill in the art at the time the invention was made to apply the MEMS technologies disclosed by Akimoto et al. to the external cavity tunable laser of Lang et al. because the combination would provide a compact laser system with precise and accurate tunable wavelength range.

A proper analysis of the obviousness/nonobviousness of the claimed invention under 35 U.S.C. §103(a) requires consideration of two factors: (1) whether the prior art would have suggested to those of ordinary skill in the art that they should carry out the claimed invention; and (2) whether the prior art would also have revealed that in so carrying out the claimed invention, those of ordinary skill would have a reasonable expectation of success. Both the suggestion and the reasonable expectation of success must be founded in the prior art, not in the applicant's disclosure. In re Sernaker, 217 U.S.P.Q. 1, at 5 (Fed. Cir. 1983); and In re Vaeck, 20 U.S.P.Q.2d 1438, 1442 (CAFC 1991).

In the present case, the rejection of the claims under 35 U.S.C. §103 is in error because Lang et al. fail to provide the requisite suggestion/motivation to provide a laser assembly of the type called for therein having, among other things, an electromechanical microactuator coupled

to one of the diffractive element and the reflective element. The Examiner acknowledges that Lang et al. fail to disclose a microactuator. In addition, however, Lang et al. fail to disclose any actuator, let alone an actuator coupled to one of the diffractive element and the reflective element. A reader of Lang et al. is left to his or her imagination as to how movement of any of the elements therein should be accomplished.

Similarly, Akimoto et al. do not provide the requisite motivation to add a microactuator to a laser assembly of the type disclosed in Lang et al. For example, Akimoto et al. do not disclose a laser device having a diffractive element as called for in Claim 1. Nor do Akimoto et al. disclose a single mode laser microassembly. Rather, Akimoto et al. merely disclose a device having a Fabry-Perot device with a linear translatable mirror element. As such, Akimoto et al. disclose a multi-mode laser device which tends to lase simultaneously at a variety of closely-spaced wavelengths. The difficulty, if not impossibility, of the Akimoto et al. device to operate at a single longitudinal mode is depicted in Fig. 15 thereof. As shown therein for a driving voltage of zero volts, for example, outputs are provided at 1539 nm, 1540.5 nm, 1541.3 nm, 1542.5 nm, 1543.5 nm and 1545 nm. It also appears from the data in Fig. 15 that the laser device disclosed in Akimoto et al. cannot be controlled adequately on a given longitudinal mode and, instead, spontaneously hops between adjacent modes when tuned over various voltages. Such behavior of the Akimoto et al. device makes it unacceptable for most commercial uses. The ability of the laser microassembly of Claim 1 to operate on a single frequency is an important feature of the invention and a significant challenge overcome by the inventors.

Even if a microactuator of Akimoto et al. was combined with a device of the type disclosed in Lang et al., there is no suggestion or disclosure in the prior art that in so carrying out such combination those of ordinary skill would have a reasonable expectation of success. As stated in the instant application beginning on Page 2, line 12 with respect to the disclosure of Lang et al.:

> *The grating-based external cavity tunable laser (ECLs) of 5,771,252 is a relatively large, expensive device that is not suitable for use as a transmitter in a large-scale WDM network. Because of the size and distance between components, assembly and alignment of the prior art ECL above is difficult to achieve. Known prior art ECLs use stepper motors for coarse positioning and piezoelectric actuators for fine positioning of wavelength selective components. Because piezoelectric actuators exhibit hysteresis, precise temperature control is needed. In addition, prior art ECL lasers are not robust in the presence of shock and vibration.*

As noted above with respect to Akimoto et al., a single mode laser device is not disclosed therein. Furthermore, and as can be appreciated by those skilled in the art, the field of

microactuator design is still nascent. Contrary to the belief of the Examiner, it cannot be assumed that any particular actuator configuration can be developed or is physically possible. Hence, there is no reasonable expectation that the inclusion of a microactuator in a tunable laser of the type disclosed in Lang et al. would be successful in producing a single mode laser assembly, let alone a single mode laser microassembly as called for in Claim 1.

In view of the foregoing, the Examiner's rejection of Claim 1 as being obvious over Lang et al. in view of Akimoto et al. is improper and should be withdrawn. Claim 1 should be found allowable.

Claims 2-12 depend from Claim 1 and are patentable for the same reasons as Claim 1 and by reason of the additional limitations called for therein. Claim 4 is additionally patentable by providing that the displacement of the reflective element comprises an angular displacement. There is certainly no disclosure in Akimoto et al. of a microactuator that provides such displacement, let alone a suggestion as to how such a microactuator could be developed and used to provide a single mode laser microassembly. Claim 5 is additionally patentable by providing that the angular displacement occurs about a virtual pivot point and Claim 6 is additionally patentable by providing that the displacement comprises a translation and a rotation. The additional limitations of Claims 5 and 6 are not suggested or disclosed by the prior art.

Claim 13 is patentable by calling for a tunable laser of the type set forth therein in which, among other things, the micro-actuator includes a substrate and at least one rotary comb drive carried by the substrate. Contrary to the assertion of the Examiner, Akimoto et al. do not disclose a microactuator having at least one rotary comb drive. Nor does Akimoto suggest or disclose such a microctuator for use with a tunable laser of the type disclosed by Lang et al. so as to provide a tunable laser as called for in Claim 13. As discussed above, the nascent nature of microactuator design precludes one from assuming that any particular microactuator configuration can be developed or is physically possible.

Claims 14-15 depend from Claim 13 and are patentable for the same reasons as Claim 13 and by reason of the additional limitations called for therein.

Claim 16 is patentable for reasons similar to those discussed above with respect to Claim 16 by calling for a method for using a single mode laser microassembly to provide light with any wavelength selected from a range of wavelengths, comprising the steps of providing the light along an optical path, providing a diffractive element in the optical path to diffract the light, providing a reflective element in the optical path to reflect the light and selecting a single wavelength of light from the range of wavelengths by altering the optical path through displacement of a micro-actuator.

Claims 17-20 depend from Claim 16 and are patentable for the same reasons as Claim 16 and by reason of the additional limitations called for therein. For example, Claims 18 and 19 are additionally patentable for reasons discussed above with respect to Claims 6 and 5.

Claims 1, 2, 3, 5, 7, 9 and 10-12 have been provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1, 2, 3, 5, 6, 7, 10, 11, 14 and 15 of copending U.S. patent application Serial No. 09/728,212. In this regard, a Terminal Disclaimer with respect to U.S. patent application Serial No. 09/728,212 is enclosed and is assumed to overcome such provisional double patenting rejection.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with Markings to Show Changes Made."

In view of the foregoing, it is respectfully submitted that the claims of record are allowable and that the application should be passed to issue. Should the Examiner believe that the application is not in a condition for allowance and that a telephone interview would help further prosecution of this case, the Examiner is requested to contact the undersigned attorney at the phone number below.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

Amend the following claims as indicated:

1. (Thrice Amended) A single mode laser microassembly comprising a source for providing a light along an optical path with [any] a single wavelength from a range of wavelengths, a diffractive element positioned in the optical path and spaced from the source by a first distance to redirect the light, a reflective element positioned in the optical path and spaced from the diffractive element by a second distance to receive the redirected light from the diffractive element and to redirect the light back towards the diffractive element, the light being redirected by the diffractive element back towards the source, and an electromechanical micro-actuator coupled to one of the diffractive element and the reflective element for selecting the single wavelength from the range of wavelengths by altering the optical path of the light.

3. (Twice Amended) The laser microassembly of Claim [2] 1 wherein the micro-actuator is coupled to the reflective element to displace the reflective element.

7. (Twice Amended) The laser microassembly of Claim [2] 1, wherein the [miro-actuator] micro-actuator comprises a micro-machined actuator.

10. (Thrice Amended) The laser microassembly of claim [2] 1, wherein the range of wavelengths comprises from about 1520nm to about 1560nm.

16. (Thrice Amended) A method for using a single mode laser microassembly to provide light with any wavelength selected from a range of wavelengths, comprising the steps of providing the light along an optical path, providing a diffractive element in the optical path to diffract the light, providing a reflective element in the optical path to reflect the light and selecting a [particular] single wavelength of light from the range of wavelengths by altering the optical path through displacement of a micro-actuator.